

**roline**



**24**

## **Digital Multimeter**

Please read before using this equipment. USER'S MANUAL

## **Measurement Limits:**

dc Voltage	: 0.1mV to 600V
ac Voltage	: 0.1mV to 600V
dc Amperes	: 0.1µA to 10A
ac Amperes	: 0.1µA to 10A
Resistance	: 0.1Ω to 40MΩ
Continuity Check	: Beep at Approx. <50Ω in the 400Ω range

### **WARNING!**

SOURCES LIKE SMALL HAND-HELD RADIO TRANSCEIVERS, FIXED STATION RADIO AND TELEVISION TRANSMITTERS, VEHICLE RADIO TRANSMITTERS AND CELLULAR PHONES GENERATE ELECTROMAGNETIC RADIATION THAT MAY INDUCE VOLTAGES IN THE TEST LEADS OF THE MULTIMETER. IN SUCH CASES THE ACCURACY OF THE MULTIMETER CANNOT BE GUARANTEED DUE TO PHYSICAL REASONS.

### **CAUTION!**

NEVER CONNECT TO A SOURCE OF VOLTAGE WHEN YOU SELECT THE DC A, AC A, RESISTANCE MEASUREMENT, OR DIODE TEST FUNCTION.

### **WARNING!**

READ "SAFETY CONSIDERATION" BEFORE USING THIS METER.

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## **1. INTRODUCTION**

This Meter is a handheld and battery operated instrument that is designed and tested according to UL3111, IEC Publication 1010-1(EN61010-1) (Overvoltage Category III), the EMC Directive and other safety standards (see "Specifications").

## Features:

- 3<sup>3</sup>/<sub>4</sub> digit, 4000 count multimeter
- Auto ranging with manual ranging override
- Fused 400mA/10A ranges
- DC voltage basic accuracy within 0.5%
- AC 400mV range for 45Hz to 100Hz
- Max/Min recording function
- Data hold
- Continuity beeper and diode test
- 600 volts input protection on ohm range
- Surge voltage protection
- Water resistant
- Hold and Low-battery annunciations
- Auto Polarity
- Rubber boot
- Large LCD display (50.8 mm 22.8 mm)

## 2. INTERNATIONAL SYMBOLS

Before using this Meter, read the following safety information carefully. In this manual, the word "WARNING" is used for conditions and actions that pose hazard(s) to the user; the word "CAUTION" is used for conditions and actions that may damage this Meter.

### International Symbols:

 Caution, risk of electric shock

 Alternating Current (AC)

 Direct Current (DC)

 Either DC or AC

 Ground (Allowable applied voltage range between the input terminal and earth)

 Caution! (Refer to accompanying documents)

 Double Insulation (Protection Class II )

 Fuse

 2 X 1.5V, AAM or R6

 WARNING!

OBSERVE ALL SAFETY PRECAUTIONS WHEN MEASURING HIGHER VOLTAGES (AND/OR CURRENTS). TURN OFF POWER TO THE CIRCUIT UNDER TEST, SET THIS METER TO THE DESIRED FUNCTION AND RANGE, CONNECT THE TEST LEADS TO THIS METER AND THEN TO THE CIRCUIT UNDER TEST. REAPPLY POWER. IF AN ERRONEOUS READING IS OBSERVED, DISCONNECT POWER IMMEDIATELY AND RECHECK ALL SETTINGS AND CONNECTIONS.

### Safety Tips:

Exceeding the specified limits of this Meter is dangerous, and can expose the user to serious and possible fatal injury. To ensure safe and appropriate use, please follow the safety guidelines below.

- Do not try to measure any voltage that exceeds dc or ac 600V RMS.
- All AC limits are RMS values.
- Voltages above dc 60V or ac 25V RMS may constitute a serious shock hazard.
- Do not attempt to use this Meter if either the Meter or the test leads have been damaged.
- Turn off power to the circuit under test before cutting, unsoldering, or breaking the circuit. Small amounts of current can be dangerous.
- Disconnect the live test lead before disconnecting the common test lead.
- When using the test leads, keep your fingers away from probe contacts. Always grip behind the fingerguards on the probes.
- Use a current clamp if measuring any current above 10Amps.

### 3. EXPLANATION OF CONTROLS AND INDICATORS

**DIGITAL DISPLAY.** Digital readings are displayed on a 4000 count display with polarity indication and automatic decimal point placement. When this Meter is turned on, all display segments and symbols appear briefly during a selftest. The display updates three times per second.

. Power to the Meter is turned on/off.

. Toggles between dc and ac when measuring amperes (10A, mA,  $\mu$ A) and volts. When dc is selected, the symbol, DC, is displayed and when ac is selected, the symbol, AC, is displayed. Toggles between resistance ( $\Omega$ ) and continuity () when measuring resistance or checking continuity. When the Meter is in the continuity test function, the symbol, , is displayed.

. Selects the Manual Range mode; the symbol, R.H, is displayed. Press to step through the ranges (indicated by

position of the decimal point). The meter beeps whenever the range changes. To return to Autorange, press for two seconds or change to any other measurement function. R.H is no longer displayed.

. Allows you to record either the highest or lowest measurements taken. In Max/Min Recording mode, autoranging function is disabled. Press to cycle through maximum, minimum and present readings. The recording of a new maximum or minimum is indicated by beep sounds. To exit Max/Min Recording, press for two seconds. The Meter will return to Auto Range mode. But when the Meter is in the 400mV(dc or ac) range, the Meter will return to Manual Range mode.

. Freezes reading in digital display; the symbol, D.H, is displayed. Even if you remove the test probes from the circuit, D.H appears on the display. To cancel data hold, press again, or press RANGE HOLD or POWER. Or, change the measurement function.

**ROTARY SWITCH.** Describes functions that are selected by setting the rotary switch.

$\mu$ A Microamperes dc/ac

10A Amperes dc/ac

$\Omega$ / Resistance or Continuity

mA Milliamperes dc/ac

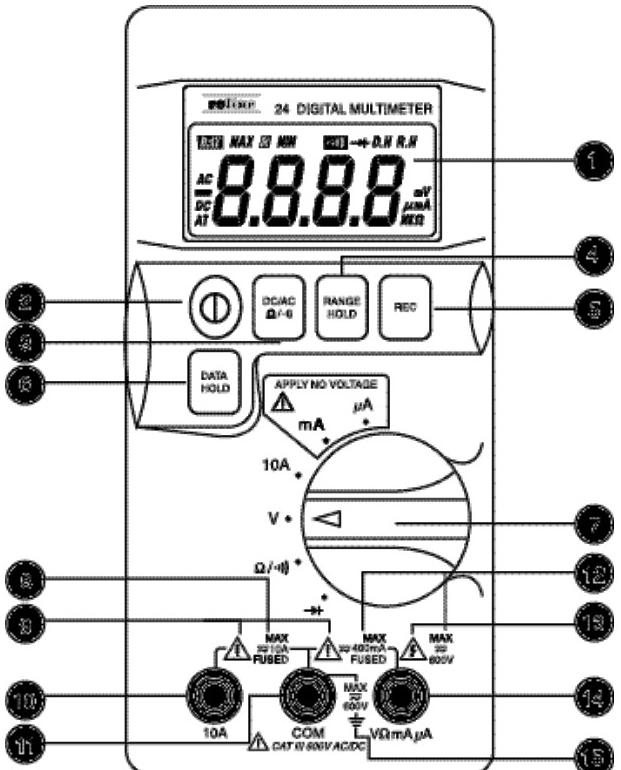
V Volts dc/ac

Diode test

. The maximum current that you can measure at this terminal is 10A dc/ac. This terminal is fuse-protected.

. Refer to the user's manual before using this Meter.

**A (Amperes Input Terminal).** The red test lead is plugged into this terminal for measuring current on the 10A ac or dc current range.



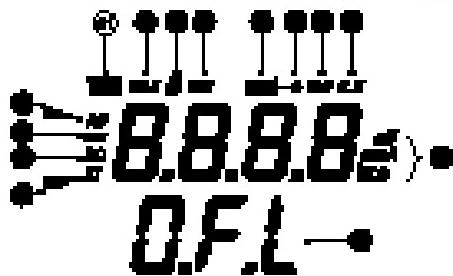
**COM (Common Terminal).** The black test lead is plugged into this terminal for all measurements.

- MAX . The maximum voltage that you can measure at this terminal is 600V dc/ac or 400mA dc/ac (fuse-protected).

**⚠️ .** Be extremely careful when making high voltage measurements; **DO NOT TOUCH TERMINALS OR TEST LEAD PROBE ENDS.**

**VΩmAμA (Volts, Ohms, Millamps, Microamps, Diode Test Input Terminal).** The red test lead is plugged into this terminal for all dc/ac volts, dc/ac millamps, dc/ac microamps, ohm, continuity test and diode test functions.

- MAX . To avoid electrical shock or instrument damage, **⚠️** do not connect the COM input terminal to any source of more than 600V with respect to earth/ground **⚠️**.



**AC .** Displayed when ac measurement function is selected.

**DC (Negative Polarity).** Automatically displayed when the input signal is negative.

**DC.** Display when dc measurement function is selected.

**AT.** Display when the Meter is in the Autorange mode.

**OFL** (**Overload Indication**). Displayed on the LCD when input is too large to display.

**LOW** (**Low Battery**). Battery run-out warning. When **LOW** is first displayed, at least 8 hours of battery life remain.

Replace the battery immediately. Never leave a weak or dead battery in the Meter.

**MAX**. Displayed when the Meter displays the highest reading.

**MIN**. Displayed along with the present reading when the  button has been pressed.

**MIN**. Displayed when the Meter displays the lowest reading.

**CONT**. Displayed when the Meter is in the continuity test function.

**D.D**. Displayed when the Meter is in the diode test function.

**D.H**. Displayed when the  button has been pressed.

**R.H**. Displayed when the  button has been pressed.

**The following symbols indicate the unit of the value displayed.**

V      Volts

mV     Millivolts      ( $1 \times 10^{-3}$  Volts )

A      Amperes        ( $1 \times 10^{-3}$  Amps )

mA     Milliamperes    ( $1 \times 10^{-6}$  Amps )

$\mu$ A   Microamperes    ( $1 \times 10^{-6}$  Amps )

$\Omega$      Ohms

K $\Omega$	Kilohm	$(1 \times 10^3$ Ohms )
M $\Omega$	Megohm	$(1 \times 10^6$ Ohms )

### Auto Range Control

In the auto range mode, the Meter automatically selects the range that gives you the best reading. The Meter automatically enters the auto range mode when you turn on power or when you select a new function. AT appears on the display and the range is automatically set to the following:

FUNCTION	Display	Range
dc V or ac V	0.000V	4V
$\mu$ A for dc A or ac A	000.0 $\mu$ A	400 $\mu$ A
mA for dc A or ac A	00.00mA	40mA
Resistance	0.FLM $\Omega$	40M $\Omega$
Continuity	OF.L $\Omega$	400 $\Omega$

**NOTE:** • You cannot use the 400mV (dc or ac) range in the auto range mode. To use the 400mV range, select manual range mode.

• For current measurements above 400mA, plug the red test lead into the 10A MAX terminal.

For current measurements of 400mA or less, plug the test lead into the V $\Omega$  mA  $\mu$ A terminal.

## Manual Range Control

The auto range mode is very convenient, but it might be faster to manually set the range when you measure values that you know to be within a certain range.

To select manual range control, repeatedly press  until the display shows the desired range. The range steps upward as you press  and R.H appears on the display.

## Change Alerting Buzzer

The buzzer sounds a single tone when you change the function setting on the rotary switch or press any button and when the range is automatically changed in the Auto Range mode.

## Using the Test Leads

Use only the same type of test leads as those supplied with the Meter. These test leads are rated for 1200 volts. Although these test leads are rated for 1200 volts, do not try to measure any voltage greater than the Meter's ratings, that is, 600 volts dc or ac.

**NOTE:** In the 400mV (dc or ac) range, with test leads not connected to any circuit, the display might show fluctuating readings. This is normal. The high input sensitivity produces a wandering effect. When you connect the test leads to a circuit, a real measurement appears.

## Using the Holster and Stand

The Meter comes with a protective holster that absorbs shocks and protects the Meter from rough handling. The holster is equipped with a stand rest.

## 4. BASIC ELECTRICAL TESTS AND MEASUREMENTS

### 4.1 Measuring Voltage

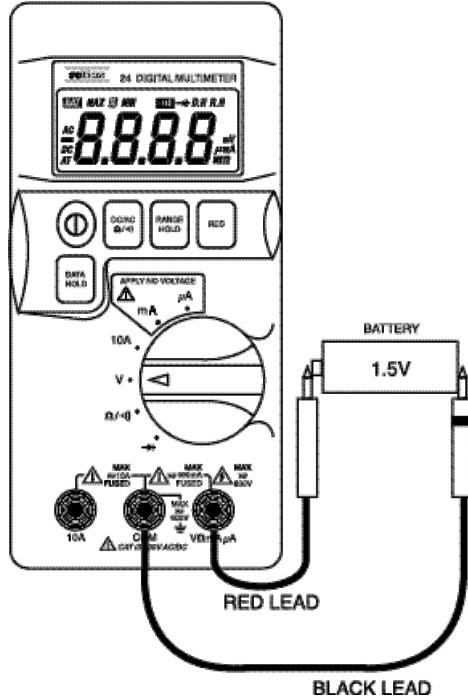


#### WARNING!

TO AVOID THE RISK OF ELECTRICAL AND INSTRUMENT DAMAGE, INPUT VOLTAGES MUST NOT EXCEED 600V DC OR 600V AC (RMS). DO NOT ATTEMPT TO TAKE ANY UNKNOWN VOLTAGE MEASUREMENT THAT MAY BE IN EXCESS OF 600V DC OR 600V AC (RMS).

THIS METER IS DESIGNED FOR MEASUREMENT IN WEAK CURRENT CIRCUITS. DO NOT USE IT FOR STRONG CURRENT CIRCUITS(POWER LINE IN FACTORIES AND SO ON HAVING LARGE CURRENT CAPACITY). USE IN STRONG CURRENT CIRCUITS IS VERY DANGEROUS BECAUSE SURGE VOLTAGE IN FAR EXCESS OF RATING IS OFTEN APPLIED TO THEM.

**NOTE:** When taking voltage measurements, this Meter must be connected in PARALLEL with the circuit, or circuit element under test.



### Follow these steps to measure dc ( or ac ) volts.

1. Set function and range switch to the desired dc V ( or ac v ) range. If you do not know the value of the voltage to be measured, always start with the highest range and reduce the setting as required to obtain a satisfactory reading.
2. Plug the red lead into the "VΩ mA μA" input terminal and the black lead into the "COM" input terminal of the instrument.
3. Disconnect the power from the circuit to be tested.
4. Connect the test leads to the circuit to be tested.
5. Reapply power to the circuit, the measured voltage will appear on the display of the instrument.
6. If the red lead is connected to the negative (or lower voltage ) side of the circuit, a minus polarity sign will appear on the display at the left.
7. Disconnect power to the circuit before removing the test leads from the circuit.

### Three-Phase AC Volts

This Meter is designed to primarily measure household ac voltage. When measuring THREE-PHASE circuits line-to-line, the value of the voltage is actually higher than the rated line-to-ground 3-phase voltage. It is very important that you do not exceed the maximum ac (RMS) rating of this Meter, 600V ac. To find the RMS voltage line-to-line on a 3-phase power line, multiply the rated line-to-ground voltage by the square root of 3 (approx. 1.732).

- To improve the accuracy of dc voltage measurements taken in the presence of ac voltages (such as, measuring the dc offset voltage of an amplifier in the presence of an ac signal ), measure the ac voltage first. Note the just measured ac voltage range and select a dc voltage range that is the same or higher than the ac voltage range. This method improves the dc voltage accuracy by preventing the input protection circuits from being activated.

For example, if you connect this Meter to a 480 volts 3-phase line (i.e. 480V line-to-ground), the total available voltage line-to-line is about 832V ac ( 480V X 1.732). Severe damage and a dangerous shock hazard could result because this exceeds the rating of this Meter.

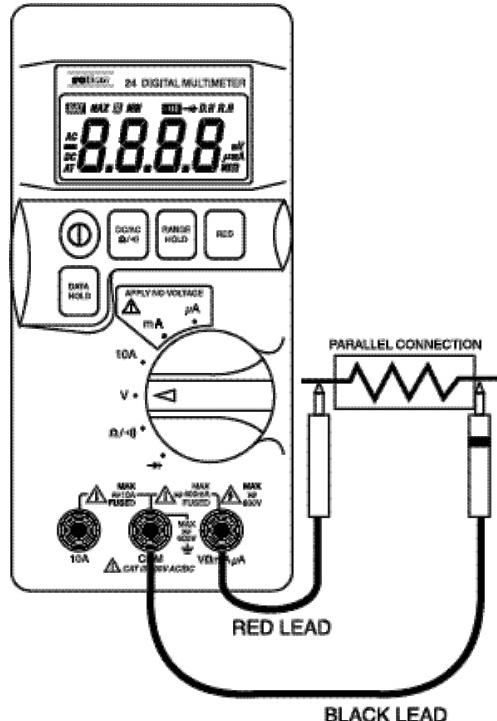
#### 4.2 Measuring Resistance (Ohms)/Continuity Test

##### CAUTION!

TURN OFF POWER AND DISCHARGE ALL CAPACITORS ON CIRCUIT TO BE TESTED BEFORE ATTEMPTING INCIRCUIT RESISTANCE MEASUREMENTS. FAILURE TO DO SO MAY END UP IN EQUIPMENT (AND/OR INSTRUMENT) DAMAGE.

THE RESISTANCE MEASURING CIRCUIT APPLIES UNKNOWN VALUE OF CONSTANT CURRENT THROUGH THE UNKNOWN RESISTANCE AND THEN MEASURES THE VOLTAGE DEVELOPED ACROSS IT. THEREFORE, REMOVE ALL POWER TO THE CIRCUIT UNDER TEST WHEN MAKING RESISTANCE MEASUREMENT. IF ANY VOLTAGE IS PRESENT IN THE TEST CIRCUIT, AN ERRONEOUS READING WILL RESULT. THIS METER MAY BE DAMAGED IF VOLTAGE IN EXCESS OF 600V ac IS PRESENT.

**NOTE:** When measuring critically low ohm values, touch tips of test leads together and record the reading. Subtract this reading from any additional measurement to obtain the most accurate value.



- When measuring large resistance, reading may be unstable due to environmentally induced electrical noise. In this case, directly connect the resistor at potential of the COM input terminal to obtain stable reading.
- For resistance above 1Megohm, the display might take a few seconds to stabilize. This is normal for high resistance readings.

- The Meter has a circuit to protect the resistance range from overvoltage (600V ac). However, to prevent accidentally exceeding the protection circuit's rating and to ensure a correct measurement, NEVER CONNECT THE TEST LEADS TO A SOURCE OF VOLTAGE when the rotary switch is set to  $\Omega/\text{beep}$  or  $\text{---}/\text{beep}$  functions.
- The current applied during resistance measurements could damage some devices. The table below lists the test voltage and current available for each resistance measurement range. (All values are typical.)

RANGE	OPEN CIRCUIT VOLTAGE (A)	FULL SCALE VOLTAGE (B)	SHORT CIRCUIT CURRENT (C)
400 $\Omega$	2.99V	315mV	760 $\mu$ A
4K $\Omega$	0.83V	560mV	409 $\mu$ A
40K $\Omega$	0.55V	435mV	50.4 $\mu$ A
400K $\Omega$	0.55V	440mV	5.6 $\mu$ A
4M $\Omega$	0.51V	414mV	0.7 $\mu$ A
40M $\Omega$	V	mV	$\mu$ A

**NOTE:** (A) is the open circuit test voltage at the input terminals in volts.  
 (B) is the voltage drop across a resistance equal to full scale value.  
 (C) is the current through a short circuit at the input terminals.

#### 4.2.1. Measuring Ohms

When measuring resistance, be sure that the contact between the test leads and the circuit under test is good. Dirt, oil, solder, flux, or other foreign matter seriously affect the reading value.

**Follow these steps to measure ohms.**

- Insert the test leads into the measurement terminals, and turn off power to the circuit under test. External voltage across the components causes erroneous readings.
- Set the rotary switch to the resistance ( $\Omega$ ) /continuity(  $\text{beep}$  ) function. Press POWER to turn on the Meter.  
 The Meter defaults to the resistance measurement mode.
- Touch the test probes to the test points, and read the display.  
 The Meter beeps when OFL( overload ) is displayed.

- NOTES:**
- During continuity or resistance checks, the probe's polarity does not matter.
  - During the auto range mode, the Meter automatically selects the appropriate range. During the manual range mode, use RANGE HOLD to select the appropriate range. OFL appears when the resistance measurement is greater than the set range.

#### 4.2.2 Continuity Test

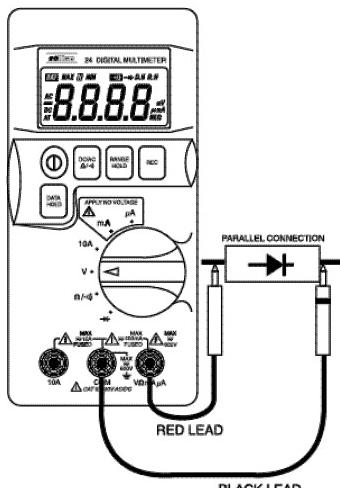
This mode helps you check electrical circuits, such as wiring, speaker cables, connections, switchers, or relays for short or open circuits. In continuity test, a measured value of approx. 50 $\Omega$  ( $\pm 30\Omega$ ) or less causes the Meter to emit a continuous tone.

## Follow these steps to check continuity.

1. Set the rotary switch to the  $\Omega$ / function.
2. Toggle until appears on the LCD to select the continuity function. The range is automatically set to  $400\Omega$  and  $OFL \Omega$  also appears on the LCD.
3. Touch the test probes to the circuit to be measured. The Meter will emit a continuous tone for the circuit resistance is 50 ohms ( $\pm 30$  ohms) or less.

## 4.3 Diode Test

Diode test lets you check diodes, transistors, and other semiconductors for opens, shorts, and normal operation. NEVER CONNECT THE TEST LEADS TO A SOURCE OF VOLTAGE when the rotary switch is set to .



- In diode test, drop voltage in the forward direction is displayed when diode is connected in the forward direction. For a germanium diode, the typical forward voltage is about 0.4V and in case of a silicon diode, about 0.6V.

- Judge the semiconductor device as follows:
  - If the digital reading in one direction shows a value and the reading in reverse direction shows an overload () , the device is good.
  - If the digital reading is the same in both directions, the device is probably shorted.
  - If the display reads in both directions, the device is probably open.

## Follow these steps to check a diode.

1. Insert the black lead into the COM terminal and the red lead into the  $V\Omega$   $mA$   $\mu A$  terminal.
2. Set the rotary switch to the function. Press POWER to turn on the Meter.
3. Touch the red lead to the Anode (+ side, non -banded end) and the black test lead to the Cathode(-side, banded end).
4. If the diode is good, the reading should indicate 0.3V to 0.8V on the LCD.
5. Reverse the red and black leads on the diode, if the LCD reads (the overload sign) the diode is good.

**NOTE:** A defective diode will read (the overload sign) or 0.00 no matter how the test leads are connected.

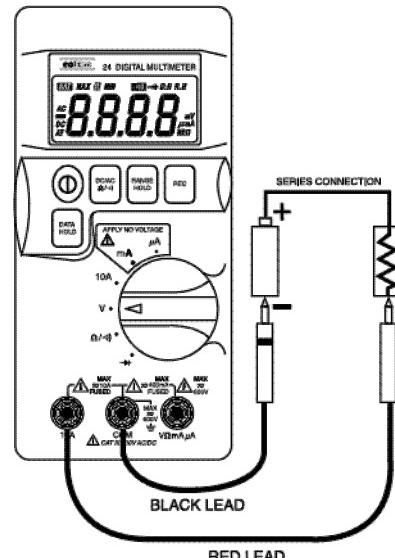
#### 4.4 Measuring Current (Amps)

##### CAUTION!

THE CURRENT FUNCTIONS ARE PROTECTED BY A FUSE OF 250 VOLT RATING. TO AVOID DAMAGE TO THE INSTRUMENT, CURRENT SOURCES HAVING OPEN CIRCUIT VOLTAGES GREATER THAN 250 VOLTS DC OR AC MUST NOT BE MEASURED.

**NOTE:** When taking current measurements, this Meter must be connected in SERIES with the circuit (or circuit element) under test. NEVER CONNECT THE TEST LEADS ACROSS A VOLTAGE SOURCE while the rotary switch is set to Amps. This can cause damage to the circuit under test or this Meter.

- To measure current, you must break the circuit and connect the test leads to two circuit connection points created by the break.
- In alternating current measurement, waveforms other than sine wave causes error.
- When measuring current, the Meter's internal shunt resistors develop a voltage across the meter's terminals called "burden voltage". This voltage drop may affect precision circuits or measurements.
- When the measured dc current's polarity is negative, the minus sign appears before the value



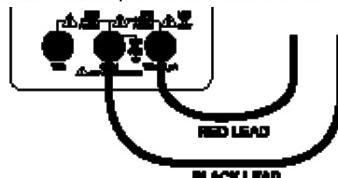
Follow these steps to measure dc(or ac) Amps.

1. Insert the test leads into the Meter as follows:

Insert the black lead into the COM terminal.

For current measurements of over 400mA (and under 10A), insert the red lead into the Meter's 10A MAX terminal as above.

For current measurement of under 400mA, insert the red lead into the Meter's VΩ mA µA terminal as below.



If you do know the amount of current to measure, always start with the highest range and reduce the setting as required to obtain a satisfactory reading.

2. Set the rotary switch to the desired 10A or mA or  $\mu$ A position.

Press POWER to turn on the Meter.

The Meter automatically defaults to the dc current measurement auto range mode.

3. To select ac, press  DC/AC. AC appears on the display.  
To return to dc, press dc/ac  again.

4. To select the manual range mode, press  . R.H appears on the display.

5. Remove power from the circuit to be measured.

6. Break the circuit at the appropriate point, then connect the test leads in series with the circuit to be tested.

7. Reapply power to the circuit, the measured current will appear on the display of the Meter.

8. Disconnect power from the circuit before removing the test leads from the circuit.

## 5. MAINTENANCE AND REPLACEABLE PARTS

### 5.1 General Maintenance

#### WARNING!

REPAIRS OR SERVICING NOT COVERED IN THIS MANUAL SHOULD ONLY BE PERFORMED BY QUALIFIED PERSONNEL. TO AVOID ELECTRICAL SHOCK, DO NOT SERVICE UNLESS YOU ARE QUALIFIED TO DO SO.

The following suggestions will help you care for the Meter so you can enjoy it for years.

- Calibrate the Meter once a year to maintain its performance specifications.
- Keep the Meter dry. If it gets wet, wipe it dry immediately. Liquids can contain minerals that can corrode electronic circuits.
- Keep the Meter away from dust and dirt, which can cause premature wear of parts.
- Handle the Meter gently and carefully. Dropping it can damage the case and the circuit boards and can cause the Meter to improperly work.
- Periodically wipe the case with a damp cloth; do not use abrasives, cleaning solvents, or strong detergents to clean the Meter.
- Use only fresh batteries of the required size and type. Always remove old or weak batteries. They can leak chemicals that destroy electronic circuits.

### 5.2 Battery Replacement

The Meter requires 2 X 1.5V("AA") batteries for power.

#### WARNING!

TO AVOID ELECTRIC SHOCK, BE SURE TO TURN OFF THE METER'S POWER AND DISCONNECT BOTH TEST LEADS FROM ANY EQUIPMENT BEFORE YOU REMOVE OR INSTALL THE BATTERIES.

### **Follow these steps to install the batteries.**

1. Remove the two screws of the battery/fuse compartment cover from the back of the Meter and lift off the cover.
2. Remove and discard the old batteries.  
Always do not expose old batteries to extreme heat or fire. They might explode and cause personal injury or damage equipment.
3. Place two fresh AA batteries in the compartment.  
If you do not plan to use the Meter for a month or more, remove the batteries. This protects the Meter from possible battery leakage.
4. Reattach the battery compartment cover to the Meter and reinstall the screws.

### **5.3 Fuse(s) Replacement**

The mA (40mA and 400mA) and  $\mu$ A(400 $\mu$ A and 4000 $\mu$ A) ranges are protected by a F1-0.5A fuse and the 4A and 10A ranges are protected by a F2-12.5A fuse. When more than 0.5A is input into the VΩ mA  $\mu$ A terminal or more than 12.5A is input into the 10A MAX terminal, the fuses in the Meter might blow and cause the display to freeze at 00.0. When this happens, replace the fuse supplied by ROTRONIC immediately.

The F2-12.5A fuse must be replaced by qualified service personnel only.

#### **WARNING!**

**TO AVOID ELECTRIC SHOCK, DISCONNECT THE TEST PROBES BEFORE REMOVING THE FUSE(S). REPLACE ONLY WITH SAME TYPE OF FUSE(S). THIS INSTRUMENT CONTAINS NO USER SERVICEABLE PARTS. SERVICE SHOULD BE PERFORMED ONLY BY QUALIFIED PERSONNEL**

### **Follow these steps to replace the fuse(s).**

1. Press POWER to turn off the Meter. The display turns off.
2. Disconnect the test leads from the circuit or component under test.
3. Open the battery/fuse compartment cover. The two fuses in the compartment are exposed.
4. Temporarily remove the batteries, if needed.  
It is not necessary to remove the batteries. However, fuse removal is easier with the batteries removed.
5. Pull the fuse's red ribbon and remove the old fuse(s) from the metal fuse holders.
6. Insert the new fuse(s) with the red ribbon in the metal holders.
7. Replace the batteries if necessary and reattach the battery compartment cover to the Meter and reinstall the screws.

### **6. ACCESSORIES**

**NOTE:** When servicing the Meter, use only the replaceable parts specified.

BT2	Battery, 1.5V("AA") X 2
F2	F 12.5A, 250V
F1	F 0.5A, 660V
FTL-500V1	Test Lead Set
C24G	Rubber Boot (Grey)

## 7. SPECIFICATIONS

### 7.1 SPECIFICATIONS

Accuracy is given as  $\pm([ \% \text{ of reading} ] + [ \text{number of least significant digits} ])$  at 18°C to 28°C with relative humidity up to 80%, for a period of one year after calibration.

#### dc volts

Range	Resolution	Accuracy	Input Impedance
400mV	0.1mV	$\pm 0.5\% + 3\text{digits}$	>100MΩ
4 V	1mV		10MΩ
40 V	10mV		
400 V	100mV		
600 V	1 V		

#### ac volts

Range	Resolution	Accuracy	Frequency (Hz)	Input Impedance
400 mV	0.1 mV	$\pm 1.5\% + 5\text{digits}$	45 ~ 100	>100MΩ
4 V	1 mV		45 ~ 400	10MΩ
40 V	10 mV		45 ~ 400	
400 V	100 mV		45 ~ 400	
600 V	1 V		45 ~ 400	

#### dc amps

Range	Resolution	Accuracy	Input Impedance
400 μA	0.1 μA	$\pm 1.2\% + 3\text{digits}$	100Ω
4000 μA	1 μA		1Ω
40 mA	10 μA		
400 mA	100 μA		
4 A	1 mA		0.01Ω
10 A	10 mA		

#### ac amps

Range	Resolution	Accuracy	Frequency (Hz)	Input Impedance
400 μA	0.1 μA	$\pm 1.5\% + 5\text{digits}$	45 ~ 400	100 Ω
4000 μA	1 μA		45 ~ 400	
40 mA	10 μA		45 ~ 400	
400 mA	100 μA		45 ~ 400	1 Ω
4 A	1 mA		45 ~ 400	
10 A	10 mA		45 ~ 400	0.01Ω

## Ohms

Range	Resolution	Accuracy	Impedance Voltage / Current
400 Ω	0.1 Ω		Vdda*/1.2 mA or less
4 KΩ	1 Ω		0.7V / 0.7 mA or less
40 KΩ	10 Ω	±0.75% + 3digits	
400 KΩ	100 Ω		0.47V / 0.7 mA or less
4 MΩ	1 KΩ	±1.0% + 3digits	
40 MΩ	10 KΩ	±1.2% + 3digits	

\* Vdda dc 3V

Continuity: Open circuit test voltage; < 3V  
threshold; approx. < 50Ω

Diode Check: Open circuit test voltage; < 2.5V  
MAX. test current; 3.1μA

## 7.2 Maximum Inputs

FUNCTION	INPUT TERMINALS		MAXIMUM INPUT
	RED LEAD	BLACK LEAD	
	VΩ mA μA	COM	600V
	VΩ mA μA	COM	600V
Ω /	VΩ mA μA	COM	600V
	VΩ mA μA	COM	600V
A	A	COM	10A/250V

FUNCTION	INPUT TERMINALS		MAXIMUM INPUT
	RED LEAD	BLACK LEAD	
mA	VΩ mA μA	COM	400mA/250V
μA	VΩ mA μA	COM	400mA/250V

FUSE PROTECTION - F1 : F 0.5A 660V  
F2 : F 12.5A 250V

## 7.3 General Specifications

Digital Display (LCD)	: Counts - 4000 Updates 3 times/sec
Storage Temperature	: -20°C to 60°C
Operating Temperature	: 0°C to 50°C
Relative Humidity	: 0% to 80%
Temperature Coefficient	: 0.10 X (Specified Accuracy)/°C (< 18°C or > 28°C)
Indoor use and Altitude	: Up to 2000m
Battery Life	: 1000 hrs typical (alkaline)
Size (H X W X L)	
Meter Only	: 155 X 76 X 40.5 (mm)
With Holster	: 168 X 85 X 50 (mm)
Weight	
Meter Only	: 0.269 (kg)
With Holster	: 0.466 (kg)
Vibration & Shock	: Designed to MIL-T-28800 for a class II instrument
Pollution Degree	: 2
Installation Category	: CAT III
Safety Standards	: Designed to both IEC 1010-1 (Overvoltage Category III) and the EMC Directive. UL3111-1, CSA C22.2 No.1010.1 and ISA-DS 82